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Union of Soviet Socialist Republics

PATENT SPECIFICATION [illegible ink stamp]

Author's Certificate

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(71) [Applicant] Central Scientific Research Institute for Traumatology and Orthopedics named after N. N. Priorov
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(56) USSR Patent No. 186085, Cl. A 61 B 17/18, 1963

(57) The invention pertains to traumatology and orthopedics, and is intended for compression in osteosynthesis, and permits increased stability of screw osteosynthesis. The device contains a plate 1 with hooked end 2, teeth 3, a slot for a wood screw 5, and a cam 6 with a notch under screw 5. The device is placed into position, and screw 5 is screwed down to cam 6, turned with the notch beneath the screw, in a clockwise direction. Plate 1 moves downwards along the femur, digging with teeth 3 into its neck. Wood screw 5 falls into the notch and locks it, which assures compression in the area of the fracture and stable fixation of the fragments of the femur, and leads to faster consolidation, with reduced likelihood of complications.

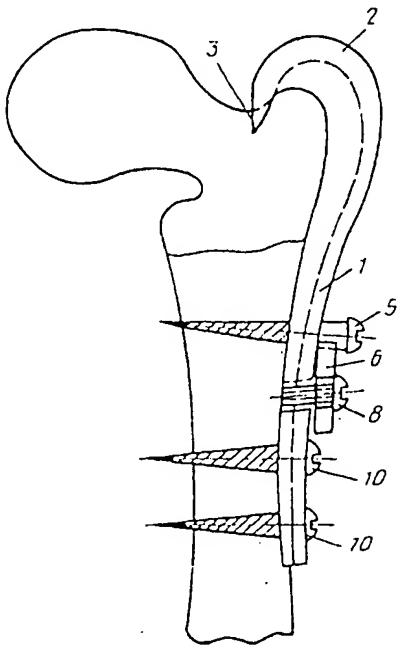

Fig. 1

The invention pertains to medical technology, in particular to traumatology and orthopedics.

The purpose of the invention is to increase the stability of screw osteosynthesis.

Figure 1 shows a compressing device for osteosynthesis of the femur in frontal projection, and Figure 2 the same in lateral projection.

The compressing device for osteosynthesis contains a plate 1 with a rounded hooked end 2, the leading edge of which has teeth 3. In plate 1 is a slot 4 through which passes an adjusting wood screw 5. Below notch 4 is a disk cam 6 with a rounded notch 7 under screw 5. Disk cam 6 is attached to plate 1 by machine screw 8 and has on its outer face holes 9 for use with a spanner wrench (not shown). Plate 1 is fastened to the bone using fixing wood screws 10.

The device is used as follows.

Via lateral access, the proximal part of the femur and part of the trochanter major are laid bare. The device is put into place in such a way that the hooked end 2 of plate 1 grabs the trochanter major from above and holds the repositioned proximal part of the femur, while plate 1 covers the area of the fracture.

Through the lower part of slot 4, one screws into the bone adjusting screw 5 adjacent to disk cam 6, turned with notch 7 beneath (the screw). Using a socket-type spanner wrench (not shown) with pins inserted into holes 9, one rotates cam 6 clockwise. Its side surface thus presses with increasing force on adjusting screw 5, forcing plate 1 to move downward along the femur. The hooked end 2, being drawn downwards, presses on the seat of the trochanter major and, digging with teeth 3 into the neck of the femur, thereby assures compression in the area of the fracture and stabilizes fixation of the fragments of the femur.

As it finishes turning, notch 7 of disk cam 6 falls under the shoulder of adjusting screw 5 and it is locked securely, assuring its immobility.

Fixing screws 10 are screwed through the pertinent holes in plate 1 into the bone, and adjusting screw 5 is tightened until its head hits the outer surface of the disk cam 6 pressed against plate 1. The wound is sutured layer-wise. After consolidation, the device is removed in the inverse order.

The use of this device assures faster consolidation times, with reduced likelihood of complications.

Patent Specification

A compressing device for osteosynthesis, containing a plate with a slot beneath an adjusting screw and holes under fixing screws, on which plate is a disk cam, characterized in that, in order to increase stability of screw osteosynthesis, the plate is made with a rounded hooked end with teeth, and the disk cam is made with a notch under the adjusting wood screw and is attached to the plate by means of a machine screw.

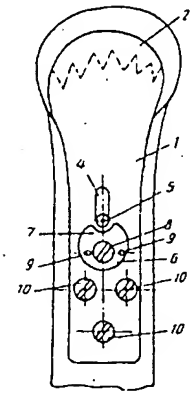

Fig. 2

СОЮЗ СОВЕТСКИХ СОЦИАЛИСТИЧЕСКИХ РЕСПУБЛИК

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ГОСУДАРСТВЕННЫЙ КОМИТЕТ СССР ПО ДЕЛАМ ИЗОБРЕТЕНИЙ И ОТКРЫТИЙ

ОПИСАНИЕ ИЗОБРЕТЕНИЯ

К АВТОРСКОМУ СВИДЕТЕЛЬСТВУ

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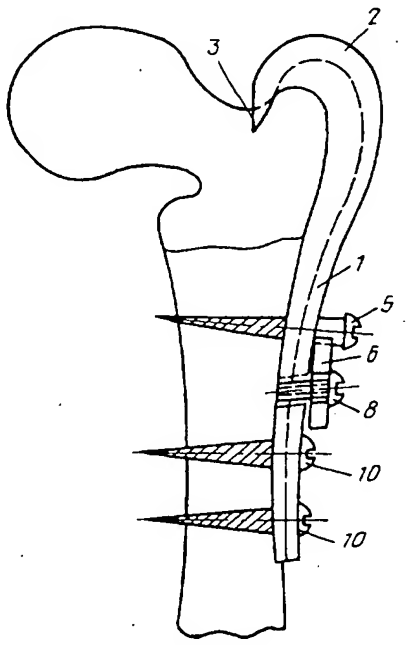
(53) 615.47:616.71-001.5-089.84 (088.8).
(56) Авторское свидетельство СССР № 186085, кл. А 61 В 17/18, 1963.

(54) КОМПРЕССИРУЮЩЕЕ УСТРОЙСТВО ДЛЯ ОСТЕОСИНТЕЗА

(57) Изобретение относится к травматологии и ортопедии, предназначено для компрессии при остеосинтезе и позволяет увеличить стабильность подвертельного остеосинтеза. Устройство содержит накладку 1 с загнутым концом 2, зубьями 3 и пазом для шурупа 5, эксцентрик 6 с лункой под шуруп 5. Устанавливают устройство, ввертывают шуруп 5 возле эксцентрика 6, повернутого лункой вниз, и вращают его по часовой стрелке. Накладка 1 опускается вдоль бедра, впиваясь зубьями 3 в шейную его часть. Шуруп 5 попадает в лунку и «защелкивается», что обеспечивает компрессию в области перелома, стабильную фиксацию отломков бедренной кости и способствует ускорению сроков консолидации при снижении вероятности осложнений. 2 ил.



Фиг.1

(19) SU (11) 1279626 A1

Изобретение относится к медицинской технике, а именно к травматологии и ортопедии.

Цель изобретения — увеличение стабильности подвертельного остеосинтеза.

На фиг. 1 изображено компрессирующее устройство для остеосинтеза бедренной кости, фронтальная проекция; на фиг. 2 — то же, боковая проекция.

Компрессирующее устройство для остеосинтеза содержит накладку 1 с загнутым концом 2 округлой формы, передняя кромка которого имеет зубья 3. На накладке 1 имеется паз 4 под регулировочный шуруп 5. Ниже паза 4 расположен дисковый эксцентрик 6 с лункой 7 под регулировочный шуруп 5. Дисковый эксцентрик 6 связан с накладкой 1 винтом 8 и имеет на наружной стороне отверстия 9 под вилочный ключ (не показан). Накладка 1 крепится накостно с помощью фиксирующих шурупов 10.

Устройство применяют следующим образом.

Боковым доступом обнажают проксимальный отдел бедра и область большого вертела. Накладывают устройство так, чтобы загнутый конец 2 накладки 1 охватил большой вертел сверху и удерживал репонированный проксимальный отдел бедра, а накладка 1 перекрывала область перелома.

Через нижнюю часть паза 4 в кость ввертывают регулировочный шуруп 5 возле дискового эксцентрика 6, повернутого лункой 7 вниз. Торцовым вилочным ключем (не показан), вставленным штырями в отверстия 9 производят вращение дискового эксцентрика 6 по часовой стрелке. При этом его боковая поверхность давит со все возрастающей силой на регулировочный шуруп 5, заставляя накладку 1 опускаться вдоль бедра. Ее загнутый конец 2, оседая, давит на седовину большого вертела и, вгрызаясь зубьями 3 в шеечную часть бедра, обеспечивает этим компрессию в области перелома и стабильную фиксацию отломков бедренной кости.

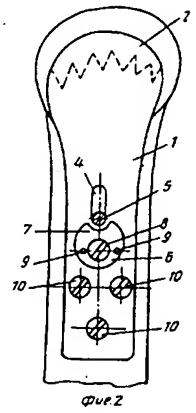
Под конец вращения дисковый эксцентрик 6 попадает лункой 7 под шейку регулировочного шурупа 5 и «защелкивается» надежно, обеспечивая свою неподвижность.

Ввертывают через соответствующие отверстия в накладке 1 фиксирующие шурупы 10 в кость и доворачивают регулировочный шуруп 5 до упора его шляпкой в наружную поверхность дискового эксцентрика 6, прижимаемого к накладке 1. Рану послойно ушивают. После консолидации, устройство удаляют в обратном порядке.

Применение предлагаемого устройства обеспечивает ускорение сроков консолидации, при снижении вероятностей осложнений.

Формула изобретения

Компрессирующее устройство для остеосинтеза, содержащее накладку с пазом под регулировочный шуруп и отверстиями под фиксирующие шурупы, на накладке установлен дисковый эксцентрик, *отличающееся* тем, что, с целью увеличения стабильности подвертельного остеосинтеза, накладка выполнена с загнутым концом округлой формы с зубьями, а дисковый эксцентрик выполнен с лункой под регулировочный шуруп и связан с накладкой с помощью винта.



Фиг.2

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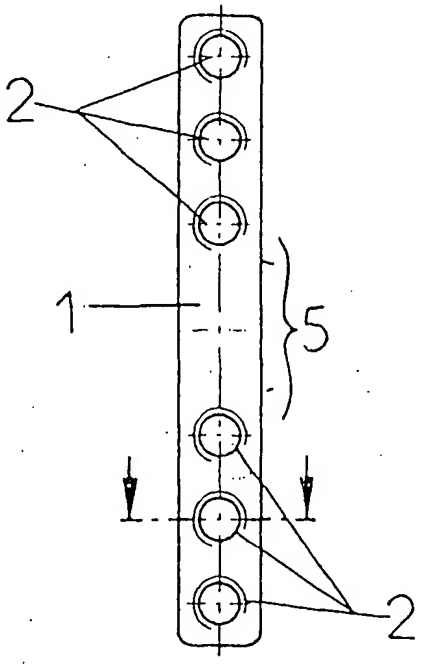
(54) Plate for osteosynthesis

(57) Plate for osteosynthesis with several holes for the accommodation of self-tapping bone screws, characterized by the fact that the holes (2) display an inside thread (3) going conically to the bone surface, whereby the bone screws (5) in the region of the screw neck (7) are provided with a conical outside thread (6), which on fastening the plate leads to an angularly stable non-positive connection.



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March 18, 1999
M/KIP-019
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Plate for osteosynthesis

Description

The invention relates to a plate for osteosynthesis with several holes for the accommodation of self-tapping bone screws.

A pressure plate for osteosynthesis known from CH-PS 637 762 has several holes arranged in the longitudinal axis of the pressure plate for the accommodation of bone screws.
The cross-sectional profile of the pressure plate is designed so that sectional planes through the pressure plate parallel to the bone surface widen with increasing distance from the bone surface. The under side of the pressure plate designated to rest on the bone in addition displays spherical recesses, so that immediately after the implantation hollow spaces result between the bone and the pressure plate.

The holes themselves are constructed as oblongs symmetrical to the longitudinal axis and have on the walls of their long sides a buttress recessed facing the upper side of the pressure plate, on which the screw head can shift parallel to the longitudinal axis. When the pressure plate is used, the bone surface is closed up by known surgical techniques, the bone fragments are joined together and aligned, the pressure plate is put on and a secure connection is produced by firm pressure and screwing with bone screws. Although the pressure plate can be more simply removed after successful healing of the bone fracture, i.e. without the assistance of instruments and without destruction of the newly formed bone lamellas of the plate bed, in fact, strong compressive forces of the pressure plate still act on the bone surface, so that the supply to the bone, and therefore its healing, is affected.

A bone plate for osteosynthesis is known from EP 0 355 035 A1 which has at least two through-holes and which is fixed on the bone by means of screws. The through-holes of the plate are in the shape of a cone so as to accommodate a correspondingly shaped screw head. The cone has a cone angle that is smaller than

the resulting angle of friction. By means of the conical bored hole and the conical head, the plate is clamped in a quasi wedge shape. Furthermore, the contact surface of the osteosynthetic device with the bone is reduced to a smaller size there. Functionally, however, forces still act between the under side of the plate and the bone, with the consequence of undesired bone compression.

It is therefore the task of the invention to provide a more developed osteosynthetic plate with several holes for the accommodation of self-tapping bone screws by means of which an angularly stable arrangement can be provided which does not rest on the bone, so that the healing time after plate osteosynthesis can be shortened and complications can be excluded.
By means of the plate, the blood circulation of the fragment under the plate should still be maintained so that there is no loss in quality of the bone.

The solution of the problem of the invention results with the invention in accordance with the characteristics in patent claim 1, with the sub-claims at least including appropriate designs and developments.

According to the invention, the holes of the plate have an inside thread running conically to the bone surface, with the bone screws in the region of the screw neck being provided with a conical outside thread. On fixation of the plate, the two threads lead to an angularly stable, in particular a non-positive and in some cases a positive connection.

With the same thread pitch, the cortical thread of the screw shaft is so designed that it has a lower height than the thread of the screw neck.

The length of the thread of the bone screw in the neck region is in general equal to the gauge or thickness of the plate. On tightening the plate, the latter is distanced from the bone. Bone compression stress due to the plate is dissipated.

By relieving the contact of the plate with the bone, and also by using monocortical screws, the plate system in accordance with the invention offers optimal conditions for undisturbed healing of the fracture, especially in fractures of the shaft.
The plate system in accordance with the invention can also bear a load just a few days post-operative. At the same time, shorter healing times are established, since the blood circulation in the fragment is maintained and the fracture hematoma is left as it was. In practice, in comparison to all conventional osteosynthetic devices, with the plate not in contact with the bone surface the vitality of the periosteum under the plate can be maintained.

Surgically, the bone plate is aligned in the usual way on the bone and put on loosely, without removing the periosteum. For the mounting, the standard twist drill, bushing or drilling jig with thread, a depth-

measurement apparatus and a screw driver are required.

Pre-boring is effectuated with the corticalis drill by way of the bushing or drilling jig that is screwed into the plate hole. The bushing or drilling jig is then removed and the depth of the drilled channel is measured. Then a corresponding self-tapping corticalis screw is screwed in until the head sinks into the plate hole and the screw shaft is anchored monocortically in the bone. The other holes are then prepared and engaged in the same way on alternate sides of the fracture.

As shown, the advantages achieved with the invention consist in that the bone plate presented does not produce a compressive connection to the surface of the bone and the stable connection of the bone fragments is achieved by clamping the head of the bone screw in the conical thread of the holes in the bone plate. In this way, the bone screw is in a position to absorb forces in all directions and to offer an angularly stable hold. The periosteum is not additionally destroyed and the healing process is improved. The fracture healing time is significantly shortened by indirect healing of the fracture, with loss of quality of the bone under the plate being precluded.

The invention will be explained below in more detail by means of examples of embodiments and with the assistance of the figures.

Shown are:

Fig. 1: a top view of an elongated osteosynthetic bone plate and also an enlarged sectional view in the region of a drilled hole;

Fig. 2a: a longitudinal section through a humerus plate;

Fig. 2b: a top view on to a humerus plate;

Fig. 2c: a section along the line A-A on the humerus plate in Fig. 2b, and an enlarged representation of the detail Y;

Fig. 2d: a section along the line B-B and a section along the line C-C of the humerus plate in Fig. 2a;

Fig. 3: a side view and a top view of a bone screw.

An osteosynthetic bone plate 1 has several holes 2, depending on its specific application, for the accommodation of bone screws 5 (Fig. 3).

The holes 2, as in the detailed representation in Fig. 1, are designed so that they have a conical threading 3 running towards the bone surface.

The bone screw 5 displays a conical outside thread 6 in the region of the screw neck 7, corresponding to the conical inside thread 3 of the plate 1. When the plate is fixed, the two threads provide for an angularly stable, non-positive connection.

With the same thread pitch, the cortical thread 9 of the screw shaft 8 is constructed so that the latter has a lower height than the thread of the screw neck 7.

The bone screw can have a hexagonal or star-shaped socket head 10 for the accommodation of corresponding forces when the screw is tightened.

As is shown in Fig. 1, the holes 2 in the plate 1 are arranged longitudinally at intervals from each other. The plate 2 [sic] shown has a connector 4 for bridging defects.

In the solution in accordance with the embodiment example and looking at Fig. 1, the osteosynthetic plate is made of stainless steel and has a width of 12 mm with a material thickness of ca. 4 mm. The plates can be made in different lengths and in different plate arrangements, with a negative conical thread being cut in each plate hole for 4.5 mm self-tapping corticalis screws (see Fig. 3).

In the neck region 7 of the screw 5 used, a high, positive conical thread 6 is cut that only catches in the thread of the respective plate hole 2.

With the same thread pitch, the cortical thread 9 of the screw shaft 8 is lower than that of the neck 7. In this way, on tightening of the screws, the plate is selectively distanced from the bone. An angularly stable construction results from the anchoring of the screw in the plate hole. On the installation side, a 2.5 mm twist auger is used for 4.5 mm screws. The pre-drilling occurs by means of a drilling jig or a bushing that is inserted by way of a thread provided in the corresponding screw-hole. The drilling jig is removed and then the depth of the drilled channel is measured, so as to screw in the appropriate self-tapping cortical screw until the screw head is recessed in the plate hole and the screw shaft is anchored monocortically in the bone.

In the form of embodiment of a humerus plate with conical threaded holes as in Figs. 2a to 2d, recourse is had to the same principle of the opposed conical thread, whereby the holes 2 with conical threads are preferably arranged in the corner points of an equilateral or isosceles triangle, as is made clear in Figs. 2b and 2c.

In another form of embodiment not shown in the drawings, at least one hole in the bone plate can display an elongated form parallel to the longitudinal axis, whereby the terminal radiuses have different measurements. The radius turned towards the site of the bone fracture is thus smaller than the radius pointing away from the bone fracture site. The corresponding hole is likewise conical in design. The advantage of this form of embodiment lies in that when the bone screw is tightened a movement along the bone plate, and thus a compression of the opposing bone fragments, occurs.

The plate in accordance with the invention was observed post-operatively, with the medical course being uneventful in all patients. Operated-on extremities could be cautiously stressed even on the day after the procedure and on the fourth day they could be stressed considerably. Complications were not detected. In the x-rays after about 20 days, a modest formation of callus was observed. After only 21 to 28 days, the fracture line was no longer detectable in the x-ray in some patients. In all patients, an easily visible callus collar was developed during the healing period. It was more intensively formed in the region of the corticalis further away from the plate. The plate was not overgrown by it.

Due to the lifting of the contact of the bone with the plate proposed according to the invention, and the use of monocortical screws, the proposed solution offers optimal conditions for undisturbed healing of the fracture in shaft fractures. In comparison to the state of the art, with the suggested solution the vitality of the periosteum under the plate is completely retained. The tissue under the plate was vital in all cases, and displayed no circulation disturbances.

In the use of the contact-free plate which is fixed monocortically, compared with bicortical and epi-periosteally fixed plates, a micro-instability results that is sufficient for the purposes of biological osteosynthesis. Since only screws with small differences in length have to be kept on hand, a costly inventory for the respective caliber of extremities or for bicortical plate fixation is unnecessary. Due to the blocking in accordance with the invention of the thread of the screw in the thread of the corresponding plate hole an angularly stable osteosynthetic method results.

Claims

1. Osteosynthetic plate with several holes for the accommodation of self-tapping bone screws, characterized by the fact that the holes (2) display an inside thread (3) running conically to the bone surface, with the bone screw (5) in the region of the screw neck (7) being provided with a conical outside thread (6), which when the plate is fixed leads to an angularly stable non-positive connection.

2. Osteosynthetic plate as in claim 1, characterized by the fact that with the same thread pitch the cortical thread (9) of the screw shaft (8) has a lower height than the thread (6) of the screw neck (7).

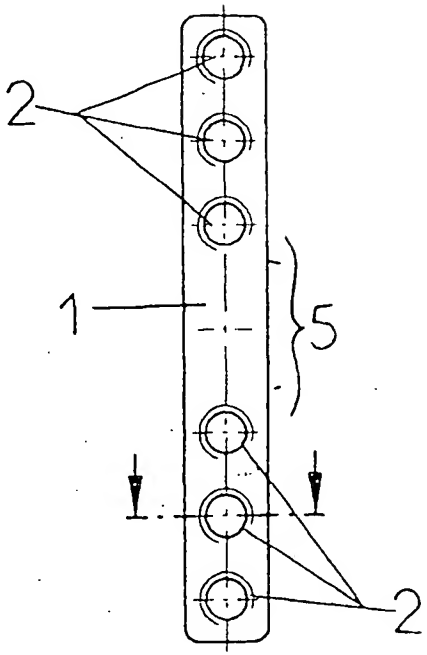
3. Osteosynthetic plate as in claim 1 or 2, characterized by the fact that the bone screw (5) displays a head with a hexagonal or star-shaped socket (10).

4. Osteosynthetic plate as in one of the preceding claims, characterized by the fact that the holes are arranged in the lengthwise direction of the plate.

5. Osteosynthetic plate as in one of the claims 1 to 4, characterized by the fact that at least one group of holes is arranged in the corner points of an equilateral or isosceles triangle.

6. Osteosynthetic plate as in one of the preceding claims, characterized by the fact that the length of the thread of the bone screw (5) in the neck region (7) corresponds essentially to the gauge or thickness of the plate.

[KEY TO TRANSLATION]: Schnitt = Section



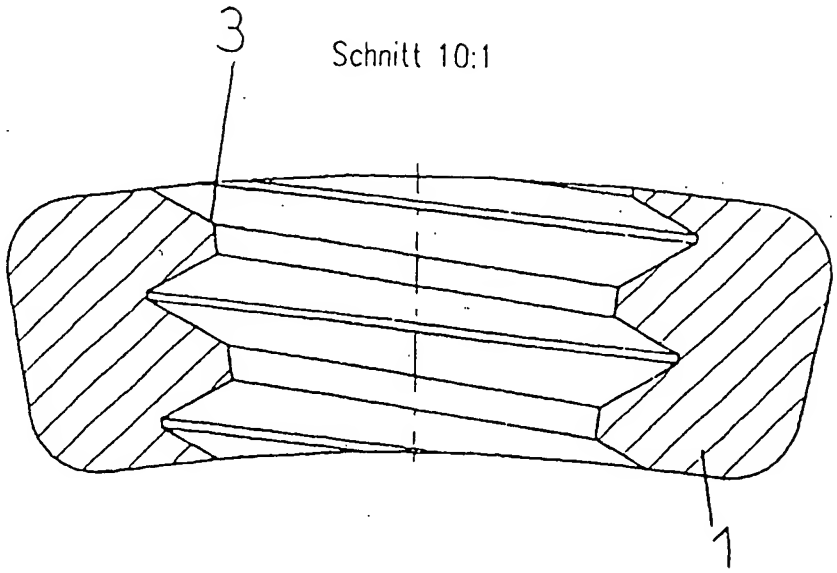
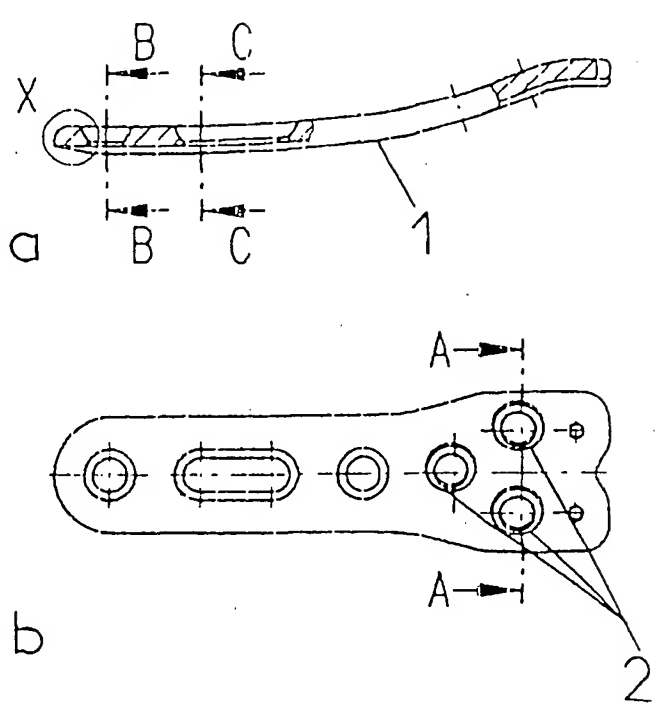


Fig. 1

[KEY TO TRANSLATION]: Schnitt = Section



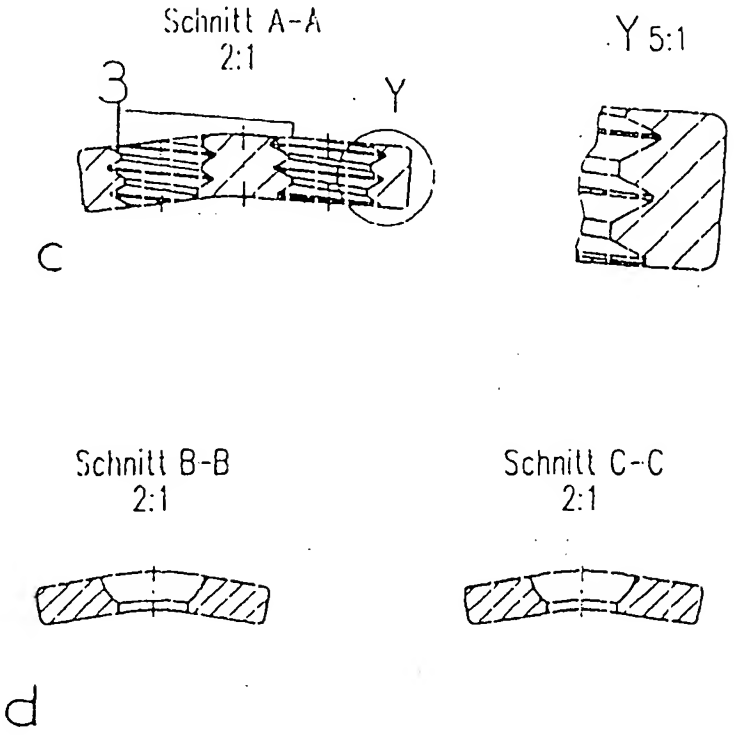


Fig. 2

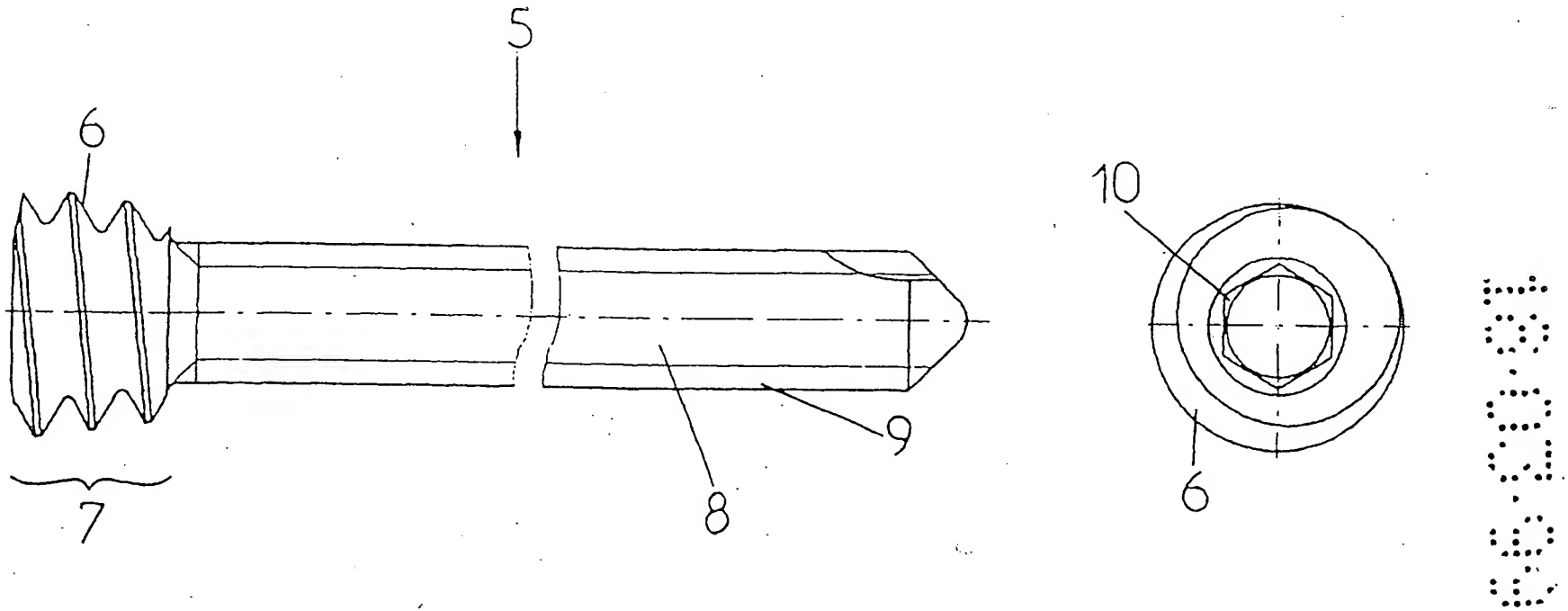


Fig. 3